THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

Polar Research Board

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Meeting Summary[1]
Polar Research Board, Special Planning Session
November 25, 2002

How Might the Polar Science Community Commemorate the Upcoming Anniversary of the International Polar Year?

PURPOSE OF THE PLANNING SESSION

The International Polar Year (1882-83) and the associated International Geophysical Year (1957-58) were major initiatives leading to significant new insights into global processes and ultimately to decades of valuable polar research. The year 2007 will mark the 125th anniversary of the International Polar Year (IPY) and the 50th anniversary of the International Geophysical Year (IGY). These historical milestones have the potential to give attention to the future of polar science – to spark exciting new research, to engage the next generation of scientists, and to publicly illustrate the benefits and challenges still inherent in polar exploration.

Polar science communities in the United States and internationally have begun discussions on how to celebrate the upcoming anniversary. Most suggest identifying a major scientific activity to garner wide community support and participation. To facilitate progress, the Polar Research Board (PRB) organized a one-day planning session on November 25, 2002, to discuss how the community might proceed in gathering ideas to commemorate IPY in 2007. The meeting was designed to facilitate open discussion of how a planning process might work, but not to advance any particular activity. Specifically, the planning session goals were to discuss:

1) What processes can be used to generate wide discussion and enthusiasm for some kind of coordinated effort that would both commemorate past IPYs and, at the same time, advance cutting-edge polar science (both Arctic and Antarctic)?
2) How do you ensure that the next generation of top researchers in polar science are involved in the development and the implementation of any planned activities?
3) How do you ensure that the diverse disciplines and communities of polar science are widely engaged? How do you involve both Arctic and Antarctic researchers?
4) How do you coordinate with other commemoration activities planned by the international polar community? Can whatever is planned be something that engages a wide audience (e.g., students, the public, the media)?

[1] Revised 1/30/2003

The session involved PRB members, invited scientists, agency participants, and others interested in the topic. Special effort was made to bring in non-US participants in order to share ideas about international activities. This meeting necessarily was a limited effort to explore how to facilitate an IPY planning process, with the expectation that other activities would follow. These meeting notes provide a brief summary of the presentations and discussions in order to give a sense of the tone and an overview of the discussion topics; they are not intended to be a transcript, which would have been difficult given the free-ranging nature of the conversations. Comments and corrections to these notes from meeting participants are welcome.

WELCOME

Robin Bell, the PRB chair, welcomed everyone and thanked the National Academy of Sciences (NAS) for providing travel funds to some of the invited speakers. She reminded everyone that the meeting objectives included discussion of how to begin planning for a "next" International Polar Year; how to identify cutting-edge science; how to involve the younger scientific community in IPY activities; and to seek ideas for commemorating IPY. She cautioned that while significant opportunities remain, celebration of IPY must be an international effort. As a context, she also reviewed the incredible accomplishments of the 1957-58 IGY/IPY, in terms of the science and for educating an entire generation of scientific leaders.

INTRODUCTORY PRESENTATIONS

Providing Historical Context: World War II, the IGY, and their Legacy for Geophysics
Speaker: Philip M. Smith

Dr. Philip Smith was a key participant in planning the IGY of 1957-58 and a long time observer of science in Washington. He noted that before World War II, funding for geophysical science was limited. There was not the range of government funding agencies we have now, only few philanthropic foundations, and there was little military interest. Between 1940 and 1960, a variety of factors combined to create the sustained federal support for fundamental scientific research that we today sometimes call "big science." One of the key people in this evolution was Vannevar Bush, head of the Office of National Science Development, who built close interactions with top war and Navy Department officials, leading them to see how science and engineering efforts could be focused to produce products and strategies that yielded advantages over the enemy.

One approach was "field service teams." These teams included groups of scientists who observed war developments and reported to the Administration on technological needs. Research stemming from these reports led to many novel and improved field technologies. However, due to limited funding new laboratory facilities were not built. Instead, research was conducted at universities, such as the radiation laboratory at the Massachusetts Institute of Technology. This established a pattern of the universities actively involved in meeting government's science needs.

Beyond being really the "first" big science effort, another legacy of the IGY was the training of a new generation of scientists. It was an exciting time, and that lured young and talented people into science. At this time, there were no boundaries between industrial and academic research, leading to ambitious, large-scale research projects.

It should be observed that all the leaders of IGY had been involved in the war effort. They were not bound by stuffy traditions and had an optimistic vision that anything planned could be accomplished. In the 1950s, Sidney Chapman and a number of others were not discouraged by the difficulties of fundraising for IGY. In fact, they organized an international committee quickly and involved 60,000 scientists in highly successful IGY research. We should not forget that the rationale for some of IGY was military (such as the spy satellite) and some scientists saw there work as patriotic, like assisting in the war. Another element was the public: IGY captured the public imagination, it fed into the optimism of the times and the sense that we could do anything; this public support was essential for changing the climate so it favored public funding of science.

The IGY was an incredible success and, from a polar perspective, it ensured the continuous presence of the U.S. in Antarctic research despite roadblocks such as cultural changes within the National Science Foundation (NSF); negotiation of the Antarctic Treat; and the termination of international cooperation in Arctic research due to the Cold War. The U.S. spent $43.5 million on IGY activities.

Historical Processes and the IPYs
Speaker: Fae Korsmo

Fae Korsmo is a program manager at NSF who is researching IGY history using the National Academy of Sciences archives and other sources of information. She has papers in preparation that include much historical detail and analysis that will tell both the story of IGY and pull out key lessons about the reasons for its success. She reminded us to remember just how large were the challenges that the IPYs each dealt with. For example, the first IPY was a tremendous effort, given the technology of the time, because it accomplished simultaneous meteorological observations that were collected hourly despite the limited infrastructure and harsh physical conditions.

She followed up on Dr. Smith's point, reminding us that the context for the 1957-58 IPY/IGY was a time when the U.S. government did not believe in supporting science. So why did it succeed? A variety of factors combined. One reason the second IPY succeeded was the leadership of entrepreneur John Fleming, the secretary of the American Geophysical Union (AGU). Fleming convinced the State Department that IPY was a matter of international prestige as a number of countries were contributing to IPY. President Hoover subsequently supported U.S. involvement in the second IPY, and he gave Fleming a one-time appropriation of $30,000. The funds were used to construct a research station on U.S. soil, while private donations funded another station on Ellesmere Island.

Fleming appealed to the public because he gave the activities a practical focus, and new how to convince others of the potential applications. He approached industries such as AT&T. Similar persuasive techniques by Lloyd Berkner led to the success of IGY. He, along with Fleming, Joseph Kaplan, Alan Waterman, and Hugh Odishaw convinced Congress, the State Department, and the White House that increasing knowledge of Earth would increase the ability to detect danger during the Cold War. Berkner also sparked civilians' interests in ionosphere research, while Odishaw ensured successful public outreach by prompting scientists to write articles for popular magazines such as Physics Today and Science; these articles were subsequently distributed to Congress. The public outreach effort was so successful that the IGY was even mentioned in comic books.

Is it Time for the Fourth International Polar Year?

Speaker: Robert Bindschadler

Dr. Bindschadler is a research scientist at NASA and involved in some of the earliest efforts to gain support for a 2007 IPY-related program of activities. He noted that polar science may deal with the far reaches of the Earth, but it is and can be a critical part of helping us understand the whole Earth system and provide wise stewardship. Past IPYs occurred at 25-50 year intervals. An IPY therefore generally comes only once in scientists' professional career. Since polar science in part focuses on the stewardship of Earth, we must accelerate our understanding of the polar regions. As a scientific community, we also need to share our knowledge with policy makers to justify expenditure of funds. Celebration of IPY is important to the polar scientific community because:

- The IPY activities will help maintain U.S. leadership in polar research
- International cooperation leverages the financial and logistic capabilities of U.S. scientists
- The United States Antarctic Program (USAP) is known for supporting exciting, critical science
- IPY can attract public attention. Public awareness, in turn, enables education on the role of polar regions in climate issues

IGY had many accomplishments and discoveries, including acquisition of new data and the cooperation of the international scientific community. But the biggest accomplishment was probably the fact that it occurred at all. The IGY planners were visionaries who dared to think big and they had the commitment and tenacity to execute their plans.

The first and second IPYs (and concurrent IGY) seem simple, in hindsight, because little was known about polar systems and exploration alone led to a lot of new information. But if there is a 2007 IPY, it will inevitably be more complex, involving exploration, monitoring, multidisciplinary study of regional processes, and global linkages. For example, discovery of subglacial lakes in Antarctica opens new doors to exploration. These exploratory activities will require clean, directed drilling and autonomous rovers. Monitoring efforts may involve satellite surveillance, remote weather and seismic stations, and selected IGY measurements that are repeated over time. The study of regional processes primarily will be multidisciplinary because these processes intersect disciplines from biochemistry to physics. Some examples of potential

study areas include calving, ice-shelf disintegration, and ice-stream-till-water interaction. Global links should be established to examine paleoclimate and hemispheric phasing, Southern Ocean dynamics and productivity, the polar vortex, etc.

In his view, Dr. Bindschadler believes the scientific community should consider a large-scale program for the celebration of IPY because it offers many potential benefits. In fact, to meet its full potential it should not be a one-year activity, but a multiyear activity kicked off in 2007. This is because several scientific disciplines would require multi-year observations to gain the kind of information needed. Perhaps, the next IPY should be an International Polar Decade (IPD) with 2007 as just the staring point. A multi-year funding program will accommodate the need for modern sciences to address complex coupled systems, and complement the existing funding profile of researchers. This would allow funding to be spread over time, as well, instead of a surge of funding in one year. More can be done, and there is more flexibility for funding agencies, with sustained funding program.

In deciding the content of IPD, projects should be examined to see if and how they fit into the program. New projects should be formulated within the U.S. polar community and collaborative projects should be formulated from the international polar community. The IPD needs endorsement from international polar communities such as International Council of Scientific Union (ICSU), and ideas for IPD must be sold to funding agencies and to Congress.

To organize IPY 2007, planning should start immediately. This meeting shows the PRB's endorsement for IPY and serves as a roadmap for the subsequent planning. In February 2003, a workshop will be held to define U.S. scientific interests. International coordination can begin during a special session at the European Geophysical Union (EGU)/AGU meeting in April 2003. An international workshop can be held in June 2003, which will lead to a draft science plan with national components. Parallel development of science plans in the U.S. and in other countries is critical because time is running out. Some of the challenges associated with an IPY are the formulation of a science plan, coordination of logistics, and the security of sufficient funding.

What is the role for Environmental Research and Education in a Future IPY?

Speaker: Stephanie Pfirman

Dr. Pfirman is a professor and researcher at Barnard College, and has been greatly interested in educating the next generation of scientists. She noted that planning for an IPY this time should look beyond the geosciences: the scope of polar environmental research is broader than climate change, geophysics, and heliophysics. Research on cold systems and their interactions should also address issues that concern Arctic residents, such as contamination and effluent management. It must address biology and ecology, which are far advanced now than in 1957-58. Polar environmental research involves spatial and temporal observations, modeling, and syntheses and analyses. It is a way to engage new polar scientists as well as a diverse public.

There are three different scales of environmental issues—local, regional and global. The focus of IPY will be on regional and global issues. One of these issues is the poleward transport and biomagnification of contaminants like PCB and DDT. Organochlorines are transported to the Arctic and Antarctic into cold traps causing serious effects on polar bears and humans in the Arctic.

There also is an increasing focus on environmental research. In year 2000, the NSB recommended the NSF budget should increase $1 billion, to $1.6 billion. In 2000-01, a NRC Grand Challenges report recommended an increase for environmental research of $1.2 billion per year over a 10-year period. The NSF will release a report on "Environmental Research and Education: A 10-year Outlook for NSF" in 2003. Some of the opportunities in polar environmental studies include:

- Changes in physical and chemical systems (for example, transport and transformation of contaminants)
- Biological interactions (for example, changes in food sources and contaminant exposure)
- Changes in human activities
- Sea ice transport

Environmental education should target non-scientists in order to broaden its impact. The Teachers Experiencing Antarctica (TEA) program and travelling exhibits are both excellent examples of polar environmental education. Polar scientists should transmit scientific discoveries and their practical applications to the public, so that the public understands the science and applies it to decision-making processes.

HOW DO WE INVOLVE DIVERSE DISCIPLINES AND BOTH ARCTIC AND ANTARCTIC RESEARCHERS?

Chair: Richard Alley

Speakers: Buford Price & Terry Wilson

Drs. Buford Price and Terry Wilson are research scientists, respectively, at Univesity of California, Berkeley, and Ohio State University. Each tried to bring the perspective of a scientist excited by the possibilities of another IPY-like activity. Dr. Price noted that planning for possible activities for 2007 is already underway indifferent circles. NASA, for instance, is planning the International Heliophysical Year (IHY), while Europe and NSA NetLander are coordinating 4 geophysical and meteorological Mars landers. There is no easy way to know all of what is happening, but it is time to start discussions. Soon, U.S. funding agencies will need to get involved. We'll need to coordinate and collaborate with other nations in the planning of IPY, because it cannot be a US-only effort.

We need to begin thinking about organizing science questions or themes, that might serve to link disparate activities. Some potential research activities are:

- Seismologic studies at Earth's poles and Mars, for example, at the South Pole, Lomonosov Ridge under Arctic Ocean, and NetLander on Mars
- Deep coring (for example, in Lomonosov Ridge, West Antarctica and permafrost in Mars)
- Borehole logging to study (or detect?) microbes and biomolecules in Antarctica, Greenland, Mars and Europa
- Robotic probing for microorganisms in subglacial lakes and oceans

Dr. Wilson noted the tremendous potential that IPY has for helping to reinvigorate the solid earth sciences. There are many related activities already being planned, that could be brought under an IPY umbrella and thus given more weight. For instance, a recent workshop focused on various drilling techniques and geophysical measurements, and it provided several good ideas for IPY. GPS and seismological monitoring technology also could be placed in Antarctica.

The interdisciplinary nature of IPY is exciting for solid earth scientists because the field is moving toward bipolar research. The theme could be selected to facilitate work at both poles.

Discussion

- As the 3rd IPY became IGY, we should think of something that is broader than IGY to galvanize another generation of scientists. For instance, working on Mars is not far-fetched.

- The IPY is an opportunity to study solar effects on Earth, which is relevant to climate and radio transmission, among others. The solar minimum and maximum will occur around 2007 and 2010, respectively, and these studies are possible if IPY is extended for 3-4 years. The National Oceanographic and Atmospheric Administration (NOAA), U.S. Air Force, airlines that fly over the poles, and insurance companies likely would be interested in Sun-Earth studies.

- Research questions or themes for IPY should be formulated to captivate politicians and the public. Are we going to lose our Arctic ice cap? How will polar bears react to a diminished ice pack? To what extent will sea level rise and how will this impact those living at sea level? Extreme environmental biology, such as origin of life and subsurface life, also may capture some excitement. Inclusion of exploration and discoveries in decision-making further may engage the public.

- The IPY can serve as a venue for funding previously planned large-scale projects. For example, SEARCH is a large-scale program that was not executed due to lack of funding. IPY could provide a kick-start for SEARCH. Potential advantages of an internationally coordinated IPY include:
  - Enabling NASA, NOAA, and NSF to fund large-scale projects.
  - Facilitating international collaboration of large-scale projects.
  - Providing infrastructure for polar studies. The public was excited by technological developments in the 1940-1960's, and as a result, new infrastructure was built in the Antarctic during IGY.

HOW DO WE MAKE SURE PLANNING AND ANY ACTIVITIES PURSUED ENGAGE THE NEXT GENERATION OF TOP RESEARCHERS?

Chair: Carole Seyfrit

Speaker: Frederick Nelson

The next generation of scientists is in the pipeline, and IPY can act as a catalyst for training polar scientists. We need to involve people who already are conducting polar research, and others who are highly trained in other disciplines.

Some potential strategies for training young scientists include:

- Targeting people with career aspirations in polar science that did not have the opportunity to explore polar research
- Establishing a series of competitive fellowships for polar research
- Involving the best undergraduate students in polar biology
- Reinforcing the role of polar science in school curricula
- Conducting high visibility education programs (e.g., groups from the lower 48 could be brought to Alaska via the Geophysical Alliance)
- Using the media (for example, TV and magazines) to engage the public in polar science
- Playing up the polar exploration in the 1800's

Speaker: Margo Edwards

Dr. Edwards is a researcher from University of Hawaii at Manoa. She noted that mid-ocean ridge research has a lot of older researchers, many with over 15 years of field experience. Competition for research funds between the older researchers and the up and coming scientists is rather difficult for the latter group. One practical solution to level the playing field is to develop an online archive for polar data sets. Young researchers then can access the archive and generate new research questions from the data sets. The data also can be used for interdisciplinary science. If atmospheric, ice and climate data are available, researchers can conduct cross-disciplinary research without actually going to the Arctic. To further educational outreach, international and/or high school competitions could ask students to devise research question based on the available data sets.

Speaker: Craig Tweedie

The legacy of bipolar studies and coordinated network approaches typically has evolved into various ongoing research efforts today. These bipolar and network approaches had a lasting effect on how young people approach high latitude sciences, notably:

- Developing the mindset that it is possible to conduct bipolar studies and carry out large, standardized, system based and integrated approaches to examining global questions.
- Shifting scientific activities from exploratory-based to process- and monitoring-based.
- Encouraging and facilitating the education and career development of students, postdoctoral researchers and youth in general.

A few ideas to involve the next generation of researchers in building the bipolar research network:

- Establishing scholarship programs that promote:
  - International exchange of students, postdoctoral fellows, etc.
  - Bipolar studies
- Resampling/revisitation of research sites established over 25 years ago for change detection. To facilitate this, the older generation of researchers, who initially established research sites, might accompany young researchers on field excursions.
- Celebrating IPY with the convention of a large bipolar meeting that incorporates a forum highlighting the achievements of young people.

Discussion

- Engaging the next generation of polar scientists requires solid funding. One issue with polar research is that scientists drift in and out of the community. To maintain a strong polar science community, we need to retain young scientists with exciting ideas. Unfortunately, young scientists tend to pursue their best career opportunities, and with a shortage of funding, the up and coming polar researchers will likely stray from polar research.

- In the 1800's and 1900's, the public was excited about the idea of polar exploration, but also by the charismatic polar explorers. Polar scientists should therefore take responsibility to engage and excite the public. One possibility is to show live broadcasts of research expeditions, instead of simply providing a research log on the web. To further the impact of polar science, high school students from the continental U.S. are traveling to Barrow to witness polar science at work. A potential strategy to further outreach is to bring teachers to the Arctic and Antarctic. These teachers then will share their experiences with colleagues at their home institutions. In this way, we can achieve an exponential dissemination of information. The British Antarctic Survey (BAS) recently created a highly informative polar science package for high schools, but despite wide circulation, few schools included it in their syllabus.

- To get young researchers involved in polar science, we should develop funds specifically for young investigators to attend workshops. A mere advertisement on a polar science conference does not necessarily encourage new researchers' participation.

HOW DO WE COORDINATE WITH INTERNATIONAL ACTIVITIES?

Chair: Robie MacDonald

Speaker: Heinz Miller

The Ice Divide of East Antarctica (IDEA) is a multinational scientific surface traverse planned for the 50th anniversary of IGY. The IDEA program includes atmospheric science, glaciology, and solid earth geoscience components. The IDEA incorporates the following:

- Study of atmospheric circulation patterns through a series of automatic weather stations and *in situ* observations throughout the troposphere
- Study of depositional patterns and mechanisms
- Linkage of major ice core deep drilling sites
- Delineation of isochrons within the ice sheet
- Precise determination of subsurface topography and conditions at bed
- Study of deep seismic sounding of the East Antarctic Lithosphere
- Gravity measurements and satellite surface validation

The IDEA requires coordination of science with standardized measurements and within logistical constraints.

During IGY and thereafter, much of our knowledge of Antarctica was obtained by surface traverses. However, Central East Antarctica remains largely unexplored. We should enrich our knowledge of this region in the spirit of IGY and the Antarctic Treaty.

Speaker: David Vaughan

The BAS heritage from IGY includes Haley Bay station, which is used and resupplied by ship each year (excluding 2001).

The BAS has a 5-year funding cycle, with the current cycle ending in March 2005. Therefore, IPY falls within the next BAS funding cycle. Since proposals must be submitted to the Natural Environment Research Council (NERC) in the next 6 months for studies in 2005, a research theme commemorating IPY should be defined soon. At present, much of the NERC-funded science has a climate change impact focus; in a long run, fundamental scientific questions need to be addressed.

Speaker: Martin Bergmann

The Arctic Ocean Studies Board (AOSB) has discussed IPY and can be used to advocate an IPY agenda at the fall AGU meeting.

The Arctic and subarctic program is monitoring the Arctic Ocean input/output balance. Arctic research ships currently include Canadian, American, and Chinese contributions. Some ideas for getting other countries involved in Arctic Ocean studies:

- Make 30% of the vessels available to international researchers.
- Link stations by moving real time information through telecommunications.

One of the four major research areas that Canada will focus on is Arctic ice, which is easily linked to the IPY. Canada also has new Arctic Research Chairs to promote further Arctic studies. The concept of an Arctic Center of Excellence will connect the Arctic researchers.

To reach out to students, Canada has a "Students on Ice" program; it places high school students on research vessels, as well as Arctic or Antarctic field stations. Canada also is logging telemetry information on whales and seals to better understand their life cycles. This type of program attracts youngsters' attention and could get them interested in polar science.

Discussion

- Scientists should work with international steering bodies to organize IPY. Agencies such as the Scientific Committee on Antarctic Research (SCAR), the International Arctic Science Committee (IASC), and AOSB could take the lead role in supporting an IPY concept and resonate the ideas to other funding agencies by 2004. The planning should involve NSF, NASA, and once a plan is finalized, it should be proposed to the Committee of Scientific Planning. The International Council of Scientific Union (ICSU) is the leading scientific organization and perhaps ICSU could organize an international workshop to generate enthusiasm about IPY in the polar science community. The advantage of getting organizations like ICSU involved is that they are politically inclined. To move the planning of IPY along, the next President of ICSU, Jane Lubchenco, and Norm Neuryder of the State Department should be contacted immediately.

- Some possible venues for generating IPY enthusiasm in the international scientific community are the Arctic Science Summit Meeting in April and the Antarctic Treaty Meeting in June. The advantage of having a session at the Arctic Science Summit Meeting is that IASC, EPB, and ASOB will be present.

- We should engage indigenous people of the Arctic in the celebration of IPY. Their involvement will add value to IPY.

WHAT KIND OF PROCESS MIGHT WE USE TO DEVELOP A PLAN FOR A NEXT IPY?

Co-Chairs: George Denton and Richard Alley

At present, several groups are planning IPY activities independently. The scientific community should knit these processes together. Within the U.S., proposals for IPY must be submitted now, as the planning cycle for FY 2005 will begin soon. We can sell the idea of increasing the science budget to commemorate IPY by noting the need to understand the resilience of natural systems and to identify sensitive ones. For instance, the polar regions are sensitive to global change, and we can learn about natural processes in them. To ensure success, we need sound science and community cohesion – not necessarily in the details but to an overall framework.

The 50th anniversary of IGY and 125th anniversary of IPY are opportunities to examine cutting edge polar science, to link polar science with global issues, and to initiate a new, large-scale research program appropriate to the 21st century. A large-scale IPY research program is justified easily since polar research has a global impact.

Many decisions remain unresolved. Do we want the IPY to be a flagship for existing science programs? Should we seek a new science program driven by technological advancements? Realistically, completed and in-progress projects should be included in IPY. We

should chose a theme built on existing programs, rather than create new ones. For example, tying an IPY with SEARCH would provide a strong framework. Nonetheless, by striving for additional IPY finds, new research concepts could be developed, new researchers could be incorporated, and the next generation of polar scientists would emerge. It is clear that financial constraints place the future of polar science in peril.

If the IPY science agenda addresses global concerns, it will have a greater chance to procure additional funding, and it will have impacts that are more global. An integrated science plan should be developed to define the goals, outline the issues, and put forth some logic that both justifies IPY and provides some implementation guidance. It should allow a wide variety of people to informally tie in as well. The IPY should not be centralized, where participation is restricted to one grand IPY proposal. Rather, by meeting a set of criteria, people could "stamp" their efforts as a part of IPY.

It is clear that IPY should be more that a single-year program, considering the modern business of science. The European effort, IDEA, is a 5-year plan and BAS funding is based on a 5-year cycle. A multiyear approach is practical, as funding is spread over multiple years, and there will be an overlap with international funding cycles, thereby making collaborative efforts easier. Furthermore, a multi-year approach will lead to better results than a quick one-shot approach. The duration of IPY should be decided after a science plan is identified.

WHERE DO WE GO FROM HERE?

Chair: Robin Bell

In this session, the PRB chair facilitated a wide-ranging brainstorming session about the types of science that might be researched (as opposed to the process for planning an effort). It was not an attempt to pick a theme, but to put forward concrete examples about how an IPY might work. Would it involve both Poles, would it tie into existing programs, etc? Participants broke into two groups and listed possible activities by Pole. The lists were subsequently compared for commonalities. Examples of key scientific issues the next IPY might focus on included:

Arctic Issues	Antarctic Issues
Hydrologic cycles and ocean dynamics [e.g. Community-wide Hydrologic Arctic Monitoring Program (CHAMP); Arctic Subarctic Ocean Fluxes (ASOF)].	Southern Ocean dynamics
Lithospheric dynamics [e.g. Joint Effort in Ocean Drilling Initiative (JEODI)]	Subglacial ice frontier
Biochemical sunrise and polar sunrise.	Limits of life

Human population and adaptation to change.	
Monitoring of spatial and temporal variability [e.g. Study of Environmental Arctic Change (SEARCH); Canadian Arctic Shelf Exchange (CASES)].	Global climate change
	Sea-level change

Participants agreed that funding poses a dilemma. The polar science community likely would embrace IPY if it leads to an infusion of new research funds. However, if IPY leads to the redistribution of existing funds, then the community will not be as interested. Although there is great excitement about IPY among the participants present, the planning and execution of IPY may face challenges along the way. A champion is needed to lead the IPY effort. Moreover, IPY celebration requires a federal earmark. Therefore, polar scientists need to focus on getting public excitement and involvement in order to justify this activity and obtain the funds. Support from NSF will be needed and ways should be sought to engage them in the discussions. It will also be necessary to build broader community support for the idea and have significant input into planning, if the overall effort is to be successful.

Robin Bell thanked all participants for their time and encouraged all to think further about how IPY might be planned and implemented. She reiterated that wide community support would be necessary to get momentum behind this effort, if planning is to proceed fast enough that proposals can be generated and submitted in time to meet the 2007 starting point.

SUMMARY OF PRB BUSINESS SESSION (RELEVANT TO IPY)

In its second day business session, the PRB noted that it was pleased with the enthusiasm of the planning discussion and the range of ideas that are circulating. It acknowledged that there is no one clear path for proceeding, no easy way to "make IPY happen" let alone build something that is integrated internationally. (Or, like in the history presentation, there no clear and powerful leader to make things happen.) The PRB is certainly not in a position to "decide" there should be a US IPY activity, or to "pick" theme or in any way impose a structure. But it sees an opportunity to provide some leadership in facilitating these discussions. This is the kind of broad, important discussion where we should be active and visible.

The PRB planned a series of steps designed to facilitate discussion and, ultimately, lead toward development of a strategy. First, it determined that it would like to get additional input on the IPY question from members of the National Academy of Sciences and National Academy of Engineering. A letter and questionnaire was designed and sent to members we could identify with interests in polar regions, or who had been active in IGY. Reponses are being received, and PRB members are making follow-up phone calls to continue the discussion. We anticipate hosting a conference call in February that will take the discussions farther, and perhaps lead to formation of a steering committee (composed of PRB members, others scientists, and agency

liaisons). Staff have been instructed to search out funding opportunities that might allow us to host a large workshop, as that kind of activity will be needed to discuss and select an overarching theme. The steering committee might, together with a workshop, assess the best way to:

- Celebrate IPY,
- Promote polar science, and
- Seek funds for IPY activities

On a concurrent track, the PRB reached out to the European Polar Board and we will be co-hosting a Town Meeting to discuss IPY cooperation, on Tuesday April 8 at the joint assembly of EGU-AGU-EGS in Nice, France. There will be an All Union session on the topic in the morning (with PRB chair Robin Bell as one of the speakers), a relevant poster session, and the Town Meeting. We are seeking ways to increase our outreach since its clear that communication is needed among the many people interested in the IPY opportunity.

Also, the PRB is designing additions to its website to allow easy access to IPY information and provide a forum for discussion. The site will be linked to other relevant sites. The interactive discussion forum is being designed and should be available for use in early April, so it can be first announced at Arctic Science Summit Week and the Nice meeting. The format will likely to include asking a series of questions and having facilitated discussions on those questions for limited periods of time.

List of Participants

PRB members, Ex-Officio Members, & Staff:
Robin Bell, Lamont-Doherty Earth Observatory, Columbia University, Palisades, New York
Richard Alley, Pennsylvania State University, University Park, Pennsylvania
George Denton, University of Maine, Orono
Robie MacDonald, Fisheries and Oceans Canada, Institute of Ocean Sciences, British Columbia
Miles McPhee, McPhee Research Company, Naches, Washington
Carole Seyfrit, Radford University, Radford, Virginia
Mahlon Kennicutt, Texas A&M University, College Station
Robert Rutford, University of Texas at Dallas
Patrick Webber, Michigan State University, East Lansing
Chris Elfring, Director, Polar Research Board
Evonne Tang, Staff Officer
Ann Carlisle, Administrative Associate

Invited Speakers:
Martin Bergmann, Department of Fisheries and Oceans, Canada; Arctic Ocean Studies Board
Robert Bindschadler, National Aeronautic and Space Administration
Margo Edwards, University of Hawaii at Manoa
Fae Korsmo, National Science Foundation, Education and Human Resources
Heinz Miller, Alfred Wegener Institute for Polar and Marine Research, Germany
Frederick Nelson, University of Delaware

Stephanie Pfirman, Barnard College
Buford Price, University of California, Berkeley
Philip Smith, McGeary and Smith, Consulting
Craig Tweedie, Michigan State University
David Vaughan, British Antarctic Survey
Terry Wilson, Ohio State University

Other Participants:
Paul Berkman, Ohio State University
Jonathan Berkson, U.S. Coast Guard
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